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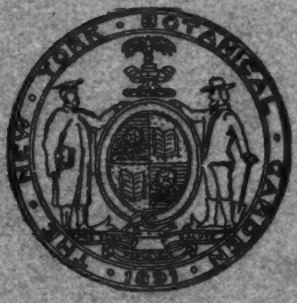

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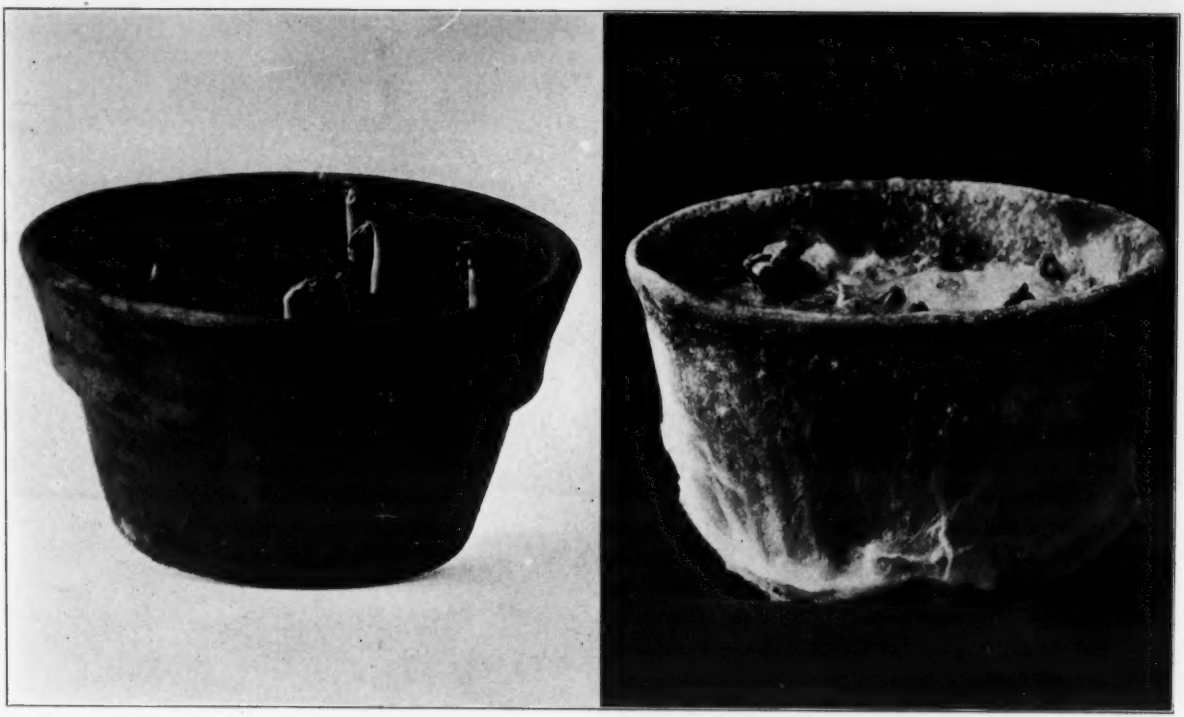
CONTENTS



SOIL CULTURES OF PYRONEMA OMPHALODES

MYCOLOGIA

VOL. I JULY, 1909 No. 4

STUDIES IN PYROPHILOUS FUNGI—I. THE OCCURRENCE AND CULTIVATION OF PYRONEMA

FRED J. SEAVER

(WITH PLATES 9–12, CONTAINING TWENTY-ONE FIGURES)

To the collector it is a well-known fact that there are numerous species of fungi which are known only on burnt places. While some of these forms may occur under other conditions, such occurrence is so rare as to have attracted comparatively little attention. Many popular reasons have been offered by individuals in explanation of these facts, such as the elimination of competition in the destruction of the higher plants, the presence of carbon in the soil, and that these forms really occur in other habitats and escape detection, but none of these reasons is sufficient to explain the occurrence of at least one of the plants in question. That these fungi do not occur on burnt places simply because the competition of the higher plants has been eliminated is shown by the fact that they do not, as a rule, occur on bare soil which has not been burned over. My own observation has also shown that carbonaceous materials are not necessary to the life of some of the pyrophilous fungi, and we must look for other explanations of these interesting phenomena.

The genus *Pyronema* includes several species, which, as the name implies, commonly inhabit burnt places. The occurrence of the plants of this genus on burnt ground is sufficiently common

[MYCOLOGIA for May, 1909 (1: 83–130), was issued 4 June 1909.]

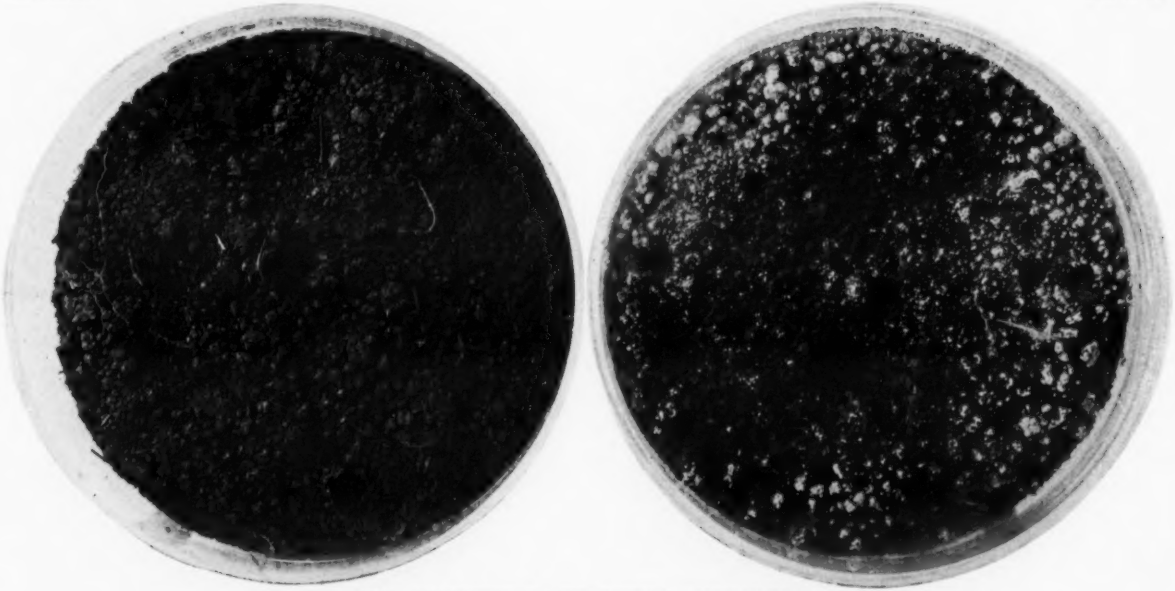
to have suggested the name of the genus, but no one has apparently considered the matter of sufficient importance to warrant investigation.* Since the most common species of the genus, *Pyronema omphalodes* (Bull.) Fuckel, is one of the few discomycetous fungi in which sexual reproduction has been demonstrated, numerous papers have been written on this phase of the subject, but in each case the matter of the occurrence of the species is dismissed with a simple statement of the fact. Nor, so far as known, has anyone taken the trouble to cultivate the species under artificial conditions either for the study of reproductive processes or in the attempt to gain information as to the reasons for its common occurrence on burnt ground.

The plants of this genus were first encountered by the writer in 1904, when the above-named species was found to be very common on burnt places near Iowa City, Iowa. Scarcely a burnt place could be visited in and about woods in wet weather on which this species was not found to be present and often in abundance, the plants appearing on charcoal and ashes and the burnt-over soil. While the individual plants are small, ranging from one to two millimeters in diameter, they commonly occur in dense confluent masses often covering a space of several inches, and by reason of their bright color they might, in spite of their small size, be counted among the more attractive forms of fungi.

The second occurrence of this species to attract the attention of the writer was during the fall of 1906 in the propagating houses of the New York Botanical Garden, where it was found to appear on soil sterilized with steam under a pressure of ten to fifteen pounds. Here the plants occurred as usual, forming rose-colored or salmon-colored sheets over the surface of the soil, the groups of plants being surrounded by a cobweb of mycelium. Under these conditions the plants seem to thrive for a time, but

* Since this paper went to press a synopsis of the article below has come to the attention of the writer showing that some of the conclusions drawn in the present paper have been previously arrived at. Although the present work was conducted without knowledge of this previous work and the line of experimentation is different, the conclusions, so far as the work has gone, are almost identical.

Kosaroff, P. Beitrag zur Biologie von *Pyronema confluens* Tul., gleichzeitig ein Beitrag zur Kenntniss der durch Sterilisation herbeigeführten Veränderungen des Bodens. Bot. Zeit. **66**: 23. 1908.



SOIL CULTURES OF PYRONEMA OMPHALODES

finally mature their fruit and disappear. The species was said to occur on soil sterilized in this manner almost without exception and had been noted for several years past by those carrying on experimental work here requiring the sterilization of soils; but as the fungus usually appeared before seeds had germinated and apparently did no harm, it did little more than to arouse a passing interest. The attention of the writer was at length called to this fungus and it was identified as *Pyronema omphalodes* (Bull.) Fuckel. The occurrence of a fungus commonly associated with burnt places on soil sterilized with steam was a fact of unusual interest, since it indicated that charcoal and carbonaceous materials are not necessary to the life of this fungus as was previously supposed.

In trying to explain these facts it at once became apparent that the high temperatures to which the substrata had been subjected had something to do with the appearance of these plants under the above conditions, but whether the high temperatures had some relation to the spores of the fungus itself in stimulating them to germination or to the substrata only in preparing it for the growth of the fungus was at that time a question.

During the summer of 1907 the species was again observed in North Dakota, where it occurred on bare soil by roadsides where there was no trace of charcoal, but in places which it is easy to suspect had been fire-swept or subjected to considerable temperatures by the heat of the sun and natural conditions of sterilization.

The last appearance of these plants and the one which has prompted the study of the problem which has been made the basis of the present paper was in agar which had been inoculated with the spores of other fungi in the laboratories of the New York Botanical Garden. The appearance of this fungus, uninvited, in three different cultures at the same time in a laboratory where to my knowledge none of the plants of the genus had been studied, even from dried material, for more than two years was sufficiently mysterious to arouse interest.

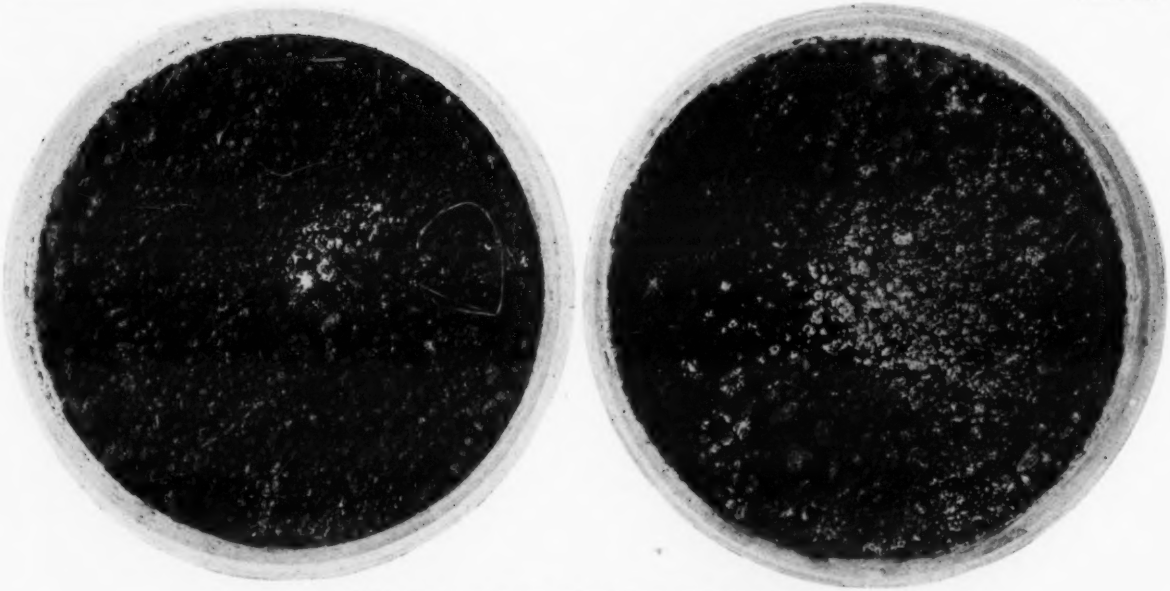
There were two possible explanations of the appearance of this fungus at this time; one that the cultures had become inoculated with the spores from the air and the other that the spores were present in the cultures and had withstood the process of steriliza-

tion. That the spores might not only be able to withstand the process of sterilization, but might even be stimulated to germination by high temperatures was suggested, since it is claimed that the spores of some of the coprophilous fungi must be subjected to the body temperature and other influences of the alimentary canal of animals in order to induce their germination.

In order to test the matter of the effect of heat on the spores of the fungus, mature ascospores were heated to various temperatures and later planted in hanging drop cultures. The heating was accomplished both with dry heat and by heating in a drop of water. In no case could the spores which had been heated to any considerable temperature be made to germinate. On the other hand, mature ascospores which had not been heated germinated readily in drop cultures, proving that if high temperatures have anything to do with the appearance of this fungus the effect is on the substratum only, the spores themselves being as sensitive to heat as are those of other species of fungi.

This species is not sufficiently common to expect that the air of the laboratory is saturated with the spores at all times, but from later experiments it is evident that these cultures were inoculated from the air. The fact that the fungus occurred in cultures in which the agar had been poured over filter paper previously heated to 110° C. for purposes of sterilization again raised the question of the relation existing between this fungus and the heating of the substratum. Cultures of agar were later tried, leaving out the filter paper, and the fungus was found to grow fully as well as in the preceding case. The luxuriant growth of this species on agar is evidence that high temperatures are not necessary in all cases to its growth. Soils sterilized with dry heat require a higher temperature to bring about favorable conditions for the growth of this fungus than are necessary for the sterilization of agar.

From our own observations and experiments there is little doubt that this fungus occurs on burnt places as a result of sterilization of such places by fire. However, it is probable that sterilization means much more than the simple elimination of competition by the destruction of bacteria and other fungi present in the soil. The nature of the changes brought about in soil by heating



SOIL CULTURES OF PYRONEMA OMPHALODES

to high temperatures is a question concerning which little is known and one which is of vital importance to the problem under consideration. While the heating of the soil destroys the fungi already present, there is every reason to believe that it prepares the way for the growth of those species which may be introduced subsequent to sterilization. The experimental work of the present paper has been based mainly on the one species, *Pyronema omphalodes* (Bull.) Fuckel, but the question of the effect of the heating of soils on the production of fungi is doubtless a large one and it is the intention of the writer to extend these investigations to other forms when fresh material can be secured for experimental work.

Some of the observations in support of the above conclusion are: in its occurrence on sterilized soil the fungus usually appears at a very early date and is mature before other forms of vegetation have had time to make any considerable growth; after maturing one crop of ascocarps the fungus gradually disappears, indicating that the most favorable time for its growth is immediately after sterilization; soil sterilized, moistened and allowed to stand for a week appears to be as unfavorable for the growth of *Pyronema* as soils which have never been sterilized, notwithstanding the fact that the soil is entirely free from other forms of vegetation so far as the eye can detect.

In its occurrence in nature on burnt ground, no notes have been made as to the relative time between the burning of the substratum and the appearance of the fungus. This would doubtless depend upon conditions of moisture. A place having been thoroughly sterilized would remain so until the return of moisture, when the *Pyronema* avails itself of the favorable conditions of sterilization and moisture and matures its crop of spores. So far as can be recalled, this species has been found on burnt places only when bare and apparently devoid of other forms of vegetation, indicating that it appears soon after burning or soon after the return of moisture to the burnt places.

In its occurrence on agar, the *Pyronema* grows rapidly, covering the surface of the agar in a three-inch petri dish in about four days. All of the cultures have been slightly contaminated with other fungi in the center of the dish, but fruit has not been

produced when the *Pyronema* has been planted in cultures already thoroughly contaminated with other fungi.

A fresh culture on agar in which the mycelium was radiating equally in all directions was contaminated by placing a drop of water rich in bacteria directly in front of the advancing mycelium. In a short time the water had evaporated, leaving only the contaminated spot. The mycelium continued to grow on both sides of the spot but refused to cross the infected area. Later, it gradually surrounded this area, which was apparently unfavorable to its growth.

In no case have I failed to produce an abundant crop of fruit in three to six days on soil sterilized under high steam pressure or with dry heat at a high temperature when such soils have been inoculated with the spores of the fungus. Indeed, such conditions are so favorable that it is difficult to prevent the fungus from invading such places even when not inoculated. On the other hand, in no case have I been able to produce more than a beginning of growth on unsterilized soil. Soils sterilized at low temperatures often produce a scant growth of ascocarps, which are, for the most part, devoid of the normal color.

The observation is made by Dr. R. A. Harper* that this plant also occurs on damp, well-rotted leaves where there has been no fire. I can account for this only on the ground that the leaves have been previously sun dried and subjected to natural conditions of sterilization, for in my experiments here every attempt to grow this fungus on unsterilized materials has failed. It is quite probable that other conditions of sterilization might give the same results as those produced by fire, but this point has not yet been demonstrated.

METHODS OF CULTIVATION FOR STUDY

The cultivation of fungi under artificial conditions is comparatively easy when we are able to meet the conditions in the laboratory under which they normally occur in nature. The apparent preference of this species for conditions of sterilization render it unusually favorable for cultivation under artificial conditions.

* Sexual Reproduction in *Pyronema confluens* and the Morphology of the Ascocarp. Ann. Bot. 14: 321. 1900.

The rapidity of growth, together with the fact that the sex organs in *Pyronema* are the largest known among the ascomycetes, should render the species of this genus of unusual interest to instructors who desire such material for study in the classroom, when the ease with which they may be artificially cultivated becomes known. The length of time during which the spores and mycelium will keep their vitality in the laboratory is a question which time alone will answer. When once the plant is started it can be cultivated generation after generation with perfect success, enabling the student to trace every step in the life-history of the plant from the germination of the spores to the production of the sex organs and, a few days later, the mature ascocarps.

The existence of sex organs in this plant has been known for many years, but it is only recently that Dr. R. A. Harper has demonstrated that these are actually functional. His study, however, was based on material collected under natural conditions, he having made no attempt to cultivate the species on nutrient media. The fact that this can be done would render the species as available for regular laboratory study as are the reproductive organs of some of the common algae.

If it is desired to study the reproductive organs from gross material, and agar is available, this is one of the best media to use, since the development of the plant can be studied in culture from day to day by placing it under the low power of a compound microscope. The surface of the agar is smooth and transparent, so that we may detect the earliest appearance of the forming fruit and these may be mounted on a slide in a drop of agar, thus eliminating grit and sand which might be present in material grown on soil. Much care must be taken to get the plants at a very early stage, for immediately after fertilization each cluster of sex organs is surrounded by the tissues of the developing ascocarp, which obscure the details of the reproductive organs.

Soil which has been heated to a high temperature is apparently more favorable for the production of the sex organs and ascocarps in large numbers than agar. In a pot of sterilized soil the fruit is produced on the pot as well as on the soil and can quite easily be removed for study. Since soil is always available and most nearly approaches the natural conditions for the growth of

the species, it is probably the most practical medium to be employed.

If plants are desired for sectioning, soft materials, such as broken leaves, may be placed on the soil and sterilized. In this case the fruit is formed in clusters on the leaves and soil. The pieces of leaves may then be removed, imbedded, and sectioned in the ordinary way, or the plants may be scraped off from the leaves and mounted and studied from the gross material.

SUMMARY

1. *Pyronema omphalodes,* which normally occurs on burnt places, can be successfully cultivated on nutrient media, producing sex organs on the fifth or sixth day and mature ascocarps in about ten days from the time of the planting of the spores.

2. This fungus will produce an abundance of fruit on soil or leaf-mold which has been sterilized by heating to high temperatures (110° C. or over), but refuses to produce fruit or any considerable mycelium on unsterilized soil or soil heated to low temperatures (less than 95° C.).

3. Sterilization by steam serves the same purpose as sterilization with dry heat, provided the soil is sterilized under sufficient pressure (5 lbs. or over). Soil sterilized under low pressure (2 lbs. or less) produces fruit only sparingly.

4. The time required to produce fruit on soil, as well as the abundance of the fruit itself, varies with the temperature to which the substratum has been subjected. Soil sterilized at 95° C. has produced no fruit; soil sterilized at 110° C. produces a fair quantity of fruit; while soil sterilized at 135°–145° C. produces fruit in abundance. The length of time of the application of the heat also has some influence.

5. Sterilization of soil by heat apparently brings about some change in the soil other than the simple elimination of competition in the destruction of bacteria and other fungi, which changes appear to be of vital importance in the cultivation of fungi which normally grow on burnt soil.

PYRONEMA OMPHALODES

EXPLANATION OF PLATES

PLATE IX

Two pots of soil, the left unsterilized, the right sterilized with dry heat at 140° C. for 15 hrs. Both were planted with seeds of pea, the sterilized pot soon becoming thoroughly infected with *Pyronema omphalodes* (Bull.) Fuckel, the unsterilized pot remaining uninfected. × ⅔.

PLATE X

Soil cultures, the left unsterilized, the right sterilized with steam under a pressure of 5 lbs. for 1–2 hrs. Both were innoculated with the spores of *Pyronema omphalodes* at a point near the center of the culture. The unsterilized culture produced no fruit and a very scant growth of mycelium surrounding the point of inoculation. The sterilized culture produced an abundant growth of mycelium and abundant fruit. × ½.

PLATE XI

Soil cultures, the left sterilized with dry heat at 110° C. for 1 hr., the right sterilized at 145° C. for 1 hr., the latter producing mycelium and fruit in much greater abundance than the former. × ½.

PLATE XII

1–2. Germination of spores of *Pyronema omphalodes* in hanging culture after 20 hrs.
3. Portion of mycelium drawn from culture grown on agar.
4. Portion of a cluster of oogonia at an early stage.
5. Cluster of oogonia drawn from material grown on agar.
6. Cluster of oogonia partially teased out.
7–13. Figures of oogonia and antherida drawn from material grown on agar.
14–15. End views of oogonia and antheridia drawn from culture material.

All the figures on this plate were sketched with the aid of a camera lucida, and are magnified 500 diameters.

NEW YORK BOTANICAL GARDEN.

THE BOLETACEAE OF NORTH AMERICA—II

WILLIAM A. MURRILL

Most of the genera of the Boletaceae were treated in the first part of this article, which appeared in the January number of MYCOLOGIA. The remaining genus includes a comparatively large number of species, many of which are rather difficult to distinguish. Owing to the perishable nature of these plants, there are also many doubtful species. For other recent papers on this group, the student is referred to Torreya **8**: 50–55, 197–200, 209–217. 1908, and to the Bulletin of the Torrey Club **35**: 517–526. *pl. 36–40.* 1908. The last two articles, on "Boleti from Western North Carolina" and "The Boleti of the Frost Herbarium," were reprinted as Garden Contributions 111 and 114.

11. CERIOMYCES Battar. Fung. Hist. 62. *pl. 29.* 1755.
Not *Ceriomyces* Corda. 1837

Leccinum S. F. Gray, Nat. Arr. Brit. Pl. **1**: 646. 1821. (Type species, *Boletus aurantiacus* Bull.)

Tubiporus Karst. Rev. Myc. **3**[9]: 16. 1881. (Type species, *Tubiporus edulis* (Bull.) Karst.)

Krombholzia Karst. Rev. Myc. **3**[9]: 17. 1881. Not *Krombholzia* Rupr. 1842. (Type species, *Krombholzia versipellis* (Fr.) Karst.)

Versipellis Quél. Ench. Fung. 157. 1886. (Type species, *Versipellis variegata* (Sw.) Quél.)

Ixocomus Quél. Myc. Fl. Fr. 411. 1888. (Type species, *Ixocomus badius* (Fr.) Quél.)

Xerocomus Quél. Myc. Fl. Fr. 417. 1888. (Type species, *Xerocomus impolitus* (Fr.) Quél.)

Hymenophore annual, terrestrial, centrally stipitate; surface dry, rarely viscid, glabrous or variously ornamented: context usually white or yellow, sometimes tinged with certain other colors, very rarely poisonous; tubes free or adnate, small, cylindrical, sometimes large and angular near the stipe: spores oblong-

ellipsoid, smooth, ochraceous to yellowish-brown: stipe solid, except in one or two species, even or reticulated, exannulate.

Type species, *Ceriomyces crassus* Battar.

Stem shaggy and lacerated, with reticulated furrows.
- Pileus dry, tomentose or reddish-pilose. — 1. *C. Russellii.*
- Pileus viscid, glabrous. — 2. *C. Betula.*

Stem smooth or reticulated with veins.
- Tubes white, not stuffed when young and not turning blue when wounded, colored at maturity with the yellowish-brown spores; pileus glabrous. A few subtomentose species have whitish tubes when young.
  - Stem smooth, pileus white, smooth. — 3. *C. albellus.*
  - Stem reticulated.
    - Pileus white, with deep chinks forming areolae. — 4. *C. frustulosus.*
    - Pileus gray, smooth. — 5. *C. griseus.*
  - Stem scabrous, pileus smooth, rarely white.
    - Stem conspicuously bright yellow near the base. — 6. *C. chromapes.*
    - Stem entirely white or grayish-white. — 7. *C. scaber.*
- Tubes flesh-colored; cap small, floccose or squamulose.
  - Pileus adorned with appressed yellowish flocci; spores 14–16 × 5–6 μ. — 8. *C. conicus.*
  - Pileus adorned with conspicuous dark purple scales; spores 9–12 × 2–3 μ. — 9. *C. Vanderbiltianus.*
- Tubes bright yellow, sometimes tinged with scarlet, unchanging at maturity or in dried specimens.
  - Stem smooth, pileus glabrous.
    - Stem 2 cm. thick; spores 15 × 6 μ. — 10. *C. flaviporus.*
    - Stem less than 1 cm. thick; spores 10 × 4 μ. — 11. *C. auriporus.*
  - Stem reticulated, pileus and stem covered with a bright yellow or scarlet tomentum or pulverulence. — 12. *C. auriflammeus.*
- Tubes some shade of yellow or brown, usually becoming darker with age. In *C. fumosipes*, *C. sordidus*, and *C. Roxanae*, the tubes are whitish when young.
  - Parasitic on species of *Scleroderma*. — 13. *C. parasiticus.*
  - Found in clusters on roots and stumps of pine; pileus bright golden-yellow. — 14. *C. hemichrysus.*
  - Found on the ground, rarely on wood much decayed and then not in clusters.
    - Tubes stuffed when young, their mouths usually white; pileus usually glabrous.

Stem furfuraceous, lilac-gray; pileus and tubes chocolate-brown. 15. *C. eximius.*

Stem smooth or reticulated; pileus and tubes of lighter color than above.

Spores brownish-ochraceous, 13–15 × 4–5 μ; stem more or less reticulated. 16. *C. crassus.*

Spores ferruginous-ochraceous, 9–12 × 4–5 μ; stem rarely reticulated at the top; pileus often olivaceous and spotted. 17. *C. affinis.*

Tubes not stuffed when young.

Pileus viscid, glabrous, small, yellow, sometimes more or less reddish-brown; stem not reticulated.

Tubes brick-colored, flesh peppery, stem solid, yellow at the base. 18. *C. piperatus.*

Tubes yellow, flesh mild.

Stem hollow, glabrous. 19. *C. Curtisii.*

Stem solid, dotted with yellow or red glandules. 20. *C. inflexus.*

Pileus glabrous or subtomentose, not viscid.

Stem reticulated, usually very distinctly so.

Pileus, tubes, and stem tawny-brown. 21. *C. tabacinus.*

Pileus yellow or brown, tubes yellow. 22. *C. retipes.*

Pileus red.

Stem bright lemon-yellow throughout; pileus without a bloom. 23. *C. speciosus.*

Stem red below, yellow above; pileus with a bloom. 24. *C. Peckii.*

Stem not reticulated, except in forms of *C. subtomentosus.*

Pileus glabrous.

Pileus red.

Stem yellow, sometimes with red stains; entire plant quickly changing to blue at any point

where touched. 25. *C. miniato-olivaceus.*

Stem red, yellow at the top; flesh and tubes slowly turning blue when wounded. 26. *C. bicolor.*

Pileus yellow or brown.

Tubes changing to blue when wounded; stem glabrous. 27. *C. pallidus.*

Tubes not changing to blue when wounded.

Stem furfuraceous, pale yellow; tubes pale yellow to greenish-yellow. 28. *C. subglabripes.*

Stem rough with minute, stiff, black hairs; tubes brown to black. 29. *C. scabripes.*

Pileus subtomentose; flesh usually spongy and drying readily.

Tubes not changing to blue when wounded.

Tubes whitish, becoming yellow; mouths small, circular. 30. *C. Roxanae.*

Tubes yellow; mouths large and angular, especially near the stem. 31. *C. subtomentosus.*

Tubes small, yellowish, becoming brick-red on drying or when bruised; pileus large, 9–13 cm. in diameter and 3 cm. thick. 32. *C. tomentipes.*

Tubes changing to blue when wounded.
Tubes at first grayish-white, discolored later by the spores; stem bluish-green at at top.
Pileus conspicuously reticulate-rimose. 33. *C. fumosipes.*
Pileus not reticulate-rimose. 34. *C. sordidus.*
Tubes yellow and large; stem and pileus usually red, the latter often cracked. 35. *C. communis.*

1. **Ceriomyces Russellii** (Frost)

Boletus Russellii Frost, Bull. Buffalo Soc. Nat. Hist. **2**: 104. 1874.

Described from specimens collected in New England by Russell. This is a very handsome and well characterized species, closely allied to *C. Betula* but extending farther north in its range, being found in open deciduous woods from New England to Mississippi and west to Wisconsin.

2. **Ceriomyces Betula** (Schw.)

Boletus Betula Schw. Schr. Nat. Ges. Leipzig **1**: 90. 1822.
Boletus Morgani Peck, Bull. Torrey Club **10**: 73. *pl. 35.* 1883. (Type from Kentucky.)

Described originally from North Carolina and afterwards found several times in that state, as well as in Georgia, Alabama, Tennessee, Ohio and Kentucky. When Schweinitz moved to Pennsylvania, he doubtless confused *C. Russellii* with the plants he had collected in North Carolina. The two species are, however, quite

distinct, *C. Betula* having a smooth, perfectly glabrous, viscid, shining testaceous cap, while that of *C. Russellii* is dry and tomentose.

3. **Ceriomyces albellus** (Peck)

Boletus albellus Peck, Ann. Rep. N. Y. State Mus. **41**: 77. 1888.

Described from Sandlake, New York, and also found in deciduous woods in Pennsylvania, District of Columbia, Virginia, West Virginia and Tennessee. The color of the cap, which is white or whitish, should at once distinguish it from nearly all other species of boleti.

4. **Ceriomyces frustulosus** (Peck)

Boletus frustulosus Peck, Bull. Torrey Club **24**: 146. 1897

Described from specimens collected in open ground and on clay banks at Ocean Springs, Mississippi, and at Akron, Alabama, by L. M. Underwood. The deep chinks in the cap are very conspicuous in the type specimens. Young specimens recently collected in Mississippi by Mrs. Earle and in the District of Columbia by myself are doubtfully referred to this species, but they show the frustulose character very slightly.

5. **Ceriomyces griseus** (Frost)

Boletus griseus Frost; Peck, Ann. Rep. N. Y. State Mus. **29**: 45. 1878.

? *Boletus flexuosipes* Peck, Bull. N. Y. State Mus. **2**: 130. 1889. (Type from North Carolina.)

Described from specimens collected by Peck at Sandlake, New York. It occurs in open woods from New England to North Carolina, and is distinguished from *C. retipes,* to which it is very closely related, by its pure white tubes, those of *C. retipes* being decidedly yellow. The cap is gray and the stem usually whitish.

6. **Ceriomyces chromapes** (Frost)

Boletus chromapes Frost, Bull. Buffalo Soc. Nat. Hist. **2**: 105. 1874.

A very attractive species, and one easily recognized by its stem, which is bright yellow near the base and finely scabrous over its entire surface. The cap is pale red and the tubes and most of

the stem white. Described from Vermont, and found commonly in open woods throughout eastern continental North America from Nova Scotia to Mississippi. I find also in the herbarium a handsome specimen of this plant mixed with certain of Baker's collections from Stanford University, California. S. Kawamura, in a recent number of the Botanical Magazine of Tokyo (**22**: (329). 1908), mentions this species as occurring in Japan, but I have not seen his specimens.

7. **Ceriomyces scaber** (Bull.)

Boletus scaber Bull. Herb. Fr. *pl. 132. f. 1.* 1782.
Boletus aurantiacus Bull. Herb. Fr. *pl. 236.* 1784.
Boletus niveus Fr. Obs. Myc. **1**: 111. 1815.
Leccinum aurantiacum S. F. Gray, Nat. Arr. Brit. Pl. **1**: 646. 1821.
Leccinum scabrum S. F. Gray, Nat. Arr. Brit. Pl. **1**: 647. 1821.
?*Boletus versipellis* Fries, Boleti 13. 1835.
Krombholzia scabra Karst. Rev. Myc. **3°**: 17. 1881.
Gyroporus scaber Quél. Ench. Fung. 162. 1886.

Described from France and common in various habitats, especially in and near woods, throughout Europe and North America. It is one of the best known and most abundant of all the boleti. The scabrous stem and the unchanging white flesh and tubes should distinguish it, in spite of the variable colors of the cap. *Boletus versipellis* of Fries (Boleti 13. 1835) seems only a variety with reddish cap and appendiculate margin.

8. **Ceriomyces conicus** (Rav.)

Boletus conicus Rav. Ann. Mag. Nat. Hist. **II. 12**: 430. 1853.

Known only from specimens collected by Ravenel in damp pine woods in South Carolina. The sporophore is small, having a conical cap adorned with appressed yellowish flocci, and the tubes are flesh-colored. I have examined the types at Harvard, and Dr. Farlow has kindly made for me an examination of their spores, which measure 14–16 × 5–6 μ.

9. **Ceriomyces Vanderbiltianus** (Murrill)

Boletus Vanderbiltianus Murrill, Torreya **8**: 215. 1908.

Described from specimens collected by the writer on the roadside in thin oak woods in Pink Bed Valley, North Carolina. The

cap is small, subconical, ornamented with conspicuous dark purple scales; the tubes are salmon-colored near the margin, becoming incarnate as the spores mature. On seeing the types of *C. conicus,* I realized at once that it was closely related to the present species, but Dr. Farlow has assured me, after a careful microscopic examination, that the difference in the size of the spores is alone sufficient to distinguish the species, those of *C. conicus* being considerably longer and about twice as broad.

10. **Ceriomyces flaviporus** (Earle)

Boletus flaviporus Earle, Bull. N. Y. Bot. Gard. **3**: 297. 1905.

Described from specimens collected by C. F. Baker at Stanford University, California. It differs from *C. auriporus* in being much larger, and in having larger spores. The general appearance of the two species is very similar.

11. **Ceriomyces auriporus** (Peck)

Boletus auriporus Peck, Ann. Rep. N. Y. State Mus. **23**: 133. 1872.

Boletus innixus Frost, Bull. Buffalo Soc. Nat. Hist. **2**: 103. 1874. (Type from Vermont.)

Boletus caespitosus Peck, Bull. Torrey Club **27**: 17. 1900. (Type from Virginia.)

This very attractive species, the tubes of which retain their golden-yellow color on drying, was originally described from North Elba, New York. It occurs in thin dry woods and on shaded roadsides throughout the eastern United States, from New England to Alabama. The cap is usually reddish-brown and the stem is viscid if the weather is not too dry.

12. **Ceriomyces auriflammeus** (Berk. & Curt.)

Boletus auriflammeus Berk. & Curt. Grevillea **1**: 36. 1872.

This species is of great interest, being very rare and very beautiful. It was originally collected in North Carolina by Rev. M. A. Curtis and sent by him to Berkeley, who described it. Peck found one plant at Sandlake, New York, and it was also reported by Beardslee from Brookside, West Virginia. A number of fine

specimens have recently been collected in North Carolina by Dr. House, Miss Burlingham and myself. The description given by Berkeley is both incomplete and inaccurate, but the bright golden-yellow color of the pileus and stem should easily distinguish it. The mouths of a few of the tubes sometimes appear scarlet, especially on drying, but this character is not at all conspicuous. The stem is beautifully reticulated.

13. **Ceriomyces parasiticus** (Bull.)

Boletus parasiticus Bull. Herb. Fr. *pl. 451. f. 1.* 1789.
Versipellis parasitica Quél. Ench. Fung. 159. 1886.
Xerocomus parasiticus Quél. Fl. Myc. 418. 1888.

Distinct from all other boleti in being parasitic. If separated from the *Scleroderma* on which it grows, it might be confused with *C. subtomentosus.* It has been found in several places in New York and New England, as well as in Europe and Asia.

14. **Ceriomyces hemichrysus** (Berk. & Curt.)

Boletus hemichrysus Berk. & Curt. Ann. Mag. Nat. Hist. **II. 12**: 429. 1853. Grevillea **1**: 35. 1872.

This very rare species was described from specimens collected by Ravenel in South Carolina on roots of *Pinus palustris.* It has since been collected in North Carolina, Alabama, New Jersey and New York, and always on roots or stumps of some species of pine. It is just possible that this is the plant found by McIlvaine in clusters on old stumps near Philadelphia and described by Peck as *Boletus fulvus.*

15. **Ceriomyces eximius** (Peck)

Boletus robustus Frost, Bull. Buffalo Soc. Nat. Hist. **2**: 104. 1874. Not *Boletus robustus* Fries. 1851.
Boletus eximius Peck, Jour. Mycol. **3**: 54. 1887.

Described from Brattleboro, Vermont, and found in thin woods and along roadsides from Nova Scotia to North Carolina and west to Pennsylvania and West Virginia. Its stem is very characteristic, being lilac-gray and furfuraceous, while the cap and tubes are chocolate-brown.

16. CERIOMYCES CRASSUS Battar. Fung. Hist. 62. *pl. 29.* 1775.

Agaricus bulbosus Schaeff. Fungi Bavar. **2**: *pl. 134.* 1763.
Boletus edulis Bull. Herb. Fr. *pl. 60.* 1781.
Boletus esculentus Pers. Obs. Myc. **1**: 23. 1794.
Leccinum edule S. F. Gray, Nat. Arr. Brit. Pl. **1**: 647. 1821.
Boletus separans Peck, Ann. Rep. N. Y. State Mus. **25**: 81. 1873. (Type from Greenbush, New York.)
Boletus decorus Frost, Bull. Buffalo Soc. Nat. Hist. **2**: 103. 1874. (Type from Brattleboro, Vermont.)
Boletus limatulus Frost, Bull. Buffalo Soc. Nat. Hist. **2**: 104. 1874. (Type from Brattleboro, Vermont.)
Boletus variipes Peck, Ann. Rep. N. Y. State Mus. **41**: 76. 1888. (Type from Menands, New York.)
Suillus bulbosus O. Kuntze, Revis. Gen. **3**: 535. 1893.
? *Boletus auripes* Peck, Ann. Rep. N. Y. State Mus. **50**: 107. 1898. (Type from Port Jefferson, New York.)
Boletus Atkinsoni Peck, Bull. N. Y. State Mus. **94**: 20. 1905. (Type from New York.)
Boletus nobilis Peck, Bull. N. Y. State Mus. **94**: 48. 1905. (Type from New York.)

This species is abundant, well known, and widely distributed in temperate regions, and, like most species of this character, it has many varieties and has received many names. The sporophore is large, with glabrous, brownish cap, white or yellowish flesh, stuffed tubes that soon change from white to yellowish or brownish, and a stout stem that is usually more or less reticulated, especially above. In Peck's variety *clavipes*, the stem is reticulated to the base, and in *B. separans* of Peck the stem, as well as the cap, is brownish-lilac in color. Most of the other American forms included in the above synonymy may be referred either to the type form or to one of the two varieties just mentioned.

17. **Ceriomyces affinis** (Peck)

Boletus affinis Peck, Ann. Rep. N. Y. State Mus. **25**: 81. 1873.
? *Boletus leprosus* Peck, Bull. N. Y. State Mus. **2**: 135. 1889. (Type from North Carolina.)
? *Boletus crassipes* Peck, Bull. Torrey Club **27**: 19. 1900. (Type from Mt. Gretna, Pennsylvania.)

Described from Greenbush, New York, and found rather commonly in thin woods from Vermont to North Carolina and west to Indiana. This species is not generally well known, but it is easily recognized after having been once carefully observed. The types of *B. leprosus* are destroyed and *B. crassipes* was described from notes and drawings only, so I have doubtfully referred them to the present species, although I have little doubt that they belong here.

18. **Ceriomyces piperatus** (Bull.)

Boletus piperatus Bull. Herb. Fr. *pl. 451. f. 2.* 1789.
Boletus ferruginatus Batsch. Elench. Fung. *f. 28.* 1783.
Leccinum piperatum S. F. Gray, Nat. Arr. Brit. Pl. **1**: 647. 1821.
Boletus Sistotrema Peck, Ann. Rep. N. Y. State Mus. **23**: 133. 1872.
Viscipellis piperata Quél. Ench. Fung. 157. 1886.
Ixocomus piperatus Quél. Fl. Myc. 414. 1888.

This species occurs throughout the northern United States and Europe in woods and open places near woods. It may be recognized by its rather small, yellow cap, acrid and peppery flesh, and brick-colored tubes.

19. **Ceriomyces Curtisii** (Berk.)

Boletus Curtisii Berk. Ann. Mag. Nat. Hist. **II. 12**: 429. 1853. Grevillea **1**: 35. 1872.
Boletus fistulosus Peck, Bull. Torrey Club **24**: 144. 1897. (Type from Auburn, Alabama.)

Described by Berkeley from specimens collected in pine woods in South Carolina by Curtis. Known to occur from North Carolina to Alabama and Mississippi. The yellow, viscid cap and slender, hollow stem should readily distinguish the species.

20. **Ceriomyces inflexus** (Peck)

Boletus inflexus Peck, Bull. Torrey Club **22**: 207. 1895.
? *Boletus rubropunctus* Peck, Ann. Rep. N. Y. State Mus. **50**: 109. 1898. (Type from Port Jefferson, New York.)

Described from specimens collected in open woods near Trexlertown, Pennsylvania, by Herbst. Difficult to distinguish from small forms of *C. scaber,* except by its yellow and smaller tubes.

21. **Ceriomyces tabacinus** (Peck)

Boletus tabacinus Peck, Bull. Torrey Club **23**: 418. 1896.

Known only from specimens collected in clay along roadsides in Alabama. Its tawny-brown cap and stem, the latter reticulated, and its peculiar habitat should distinguish the species.

22. **Ceriomyces retipes** (Berk. & Curt.)

Boletus retipes Berk. & Curt. Grevillea **1**: 36. 1872.

Boletus ornatipes Peck, Ann. Rep. N. Y. State Mus. **29**: 67. 1878. (Type from North Elba, New York.)

An attractive and well-marked species occurring commonly in thin woods from Nova Scotia to Alabama and west to Wisconsin. The cap varies in color from yellow to brown, the flesh and tubes are yellow, and the yellow stem is beautifully reticulated to the base. It was first described by Berkeley from plants collected by Curtis in North Carolina. Peck referred his first collections in New York to this species in 1872, but afterwards separated them under the name *B. ornatipes*.

23. **Ceriomyces speciosus** (Frost)

Boletus speciosus Frost, Bull. Buffalo Soc. Nat. Hist. **2**: 101. 1874.

Described from Brattleboro, Vermont, and found in thin deciduous woods from New England to North Carolina and Tennessee. It is a beautiful species, known by its apple-red cap, without bloom, and its brilliant yellow tubes and stem, the latter reticulated. *C. bicolor* and *C. Peckii* are closely related species.

24. **Ceriomyces Peckii** (Frost)

Boletus Peckii Frost, Peck, Ann. Rep. N. Y. State Mus. **29**: 45. 1878.

Boletus roscotinctus Peck, Bull. Torrey Club **27**: 612. 1900. (Type from North Carolina.)

This species occurs in rather open deciduous woods, especially along roads, and has been found from New England to North Carolina and west to Indiana. It was first described from specimens collected by Peck at Sandlake, New York. It is easily rec-

ognized by its red cap with a bloom like that of a peach. The tubes and upper part of the stem are yellow, the remainder of the stem red, and the whole stem, usually, reticulated. The stem of *C. speciosus* is entirely yellow and that of *C. bicolor* is not reticulated.

25. **Ceriomyces miniato-olivaceus** (Frost)

Boletus miniato-olivaceus Frost, Bull. Buffalo Soc. Nat. Hist. **2**: 101. 1874.

Boletus sensibilis Peck, Ann. Rep. N. Y. State Mus. **32**: 33. 1879. (Type from Gansevoort, New York.)

Boletus glabellus Peck, Ann. Rep. N. Y. State Mus. **41**: 76. 1888. (Type from Menands, New York.)

Described from Brattleboro, Vermont, from specimens collected by Frost in the borders of woods. Cap vermilion, soon fading, tubes bright yellow, stem yellow with pink markings. This species is easily distinguished among the red boleti by its quick change to blue at any point, either outside or inside, where bruised or even touched with the fingers. It occurs from Maine to North Carolina, and is said to be poisonous.

26. **Ceriomyces bicolor** (Peck)

Boletus bicolor Peck, Ann. Rep. N. Y. State Mus. **24**: 78. 1872.

Boletus rubeus Frost, Bull. Buffalo Soc. Nat. Hist. **2**: 102. 1874. (Type from Brattleboro, Vermont.)

Boletus squamulosus Ellis, Bull. Torrey Club **6**: 77. 1876. (Type from New Jersey.) Not *Boletus squamulosus* Rostk. *Boletus dichrous* Ellis, Bull. Torrey Club **6**: 109. 1876.

A beautiful species with smooth, purplish-red cap, bright yellow tubes, and smooth, red or yellow stem. When broken, both flesh and tubes change to blue. It occurs in open woods from New England to North Carolina and west to Ohio. It was originally described from Sandlake, New York, from specimens collected by Peck.

27. **Ceriomyces pallidus** (Frost)

Boletus pallidus Frost, Bull. Buffalo Soc. Nat. Hist. **2**: 105. 1874.

Described from Brattleboro, Vermont, and occurring in woods in the eastern United States from New England to Alabama. The cap and tubes are of a pallid color, the latter changing to blue when wounded.

28. **Ceriomyces subglabripes** (Peck)

Boletus flavipes Peck, Ann. Rep. N. Y. State Mus. **39**: 42. 1887. Not *Boletus flavipes* Berk.

Boletus subglabripes Peck, Bull. N. Y. State Mus. **2**: 112. 1889.

Boletus rugosiceps Peck, Bull. N. Y. State Mus. **94**: 20. *pl. 20. f. 6–10.* 1905. (Type from Port Jefferson, New York.)

Described from Caroga, New York, but found also in woods in Nova Scotia, Maine, Connecticut and Missouri. It is rather difficult to recognize because of the variable color of its cap, which is usually some shade of red or brown.

29. **Ceriomyces scabripes** (Peck)

Boletus scabripes Peck; White, Bull. Torrey Club **29**: 555. 1902.

Known only from specimens collected by Miss V. S. White at Bar Harbor, Maine, in 1901. The types and field notes are at the New York Botanical Garden. A large species with reddish-brown cap, brown, adnate tubes, and the stem ornamented with numerous small black points. On drying, it is said to exude a black juice with strong odor.

30. **Ceriomyces Roxanae** (Frost)

Boletus Roxanae Frost, Bull. Buffalo Soc. Nat. Hist. **2**: 104. 1874.

?*Boletus multipunctus* Peck, Bull. N. Y. State Mus. **54**: 952. 1902. (Type from Bolton, New York.)

Described from Brattleboro, Vermont, and known also from Maine, Connecticut, New York, Pennsylvania and North Carolina, growing in the edges of woods. The cap is yellowish-brown, with minute, floccose tufts, which partially disappear with age; while the margin is rather unusual in often curving or rolling upward on drying.

31. **Ceriomyces subtomentosus** (L.)

Boletus subtomentosus L., Sp. Pl. 1178. 1753.

Ceriomyces jujubinus procerus Battar. Fung. Hist. 64. 1755.

?*Boletus communis* Bull. Herb. Fr. *pl. 393B.* 1788.

Boletus crassipes Schaeff. Fungi Bavar. *pl. 112.* 1763.

Leccinum subtomentosum S. F. Gray, Nat. Arr. Brit. Pl. **1**: 647. 1821.

Rostkovites subtomentosus Karst. Rev. Myc. 3[9]: 16. 1881.
Versipellis subtomentosus Quél. Ench. Fung. 158. 1886.
Xerocomus subtomentosus Quél. Fl. Myc. 418. 1888.
? *Boletus alutaceus* Morgan; Peck, Bull. N. Y. State Mus. **2**: 109. 1889. (Type from Kentucky.)
Boletus illudens Peck, Ann. Rep. N. Y. State Mus. **50**: 108. 1898. (Type from Port Jefferson, New York.)

This widespread species, of general distribution in deciduous woods throughout Europe and temperate North America, has many varieties and has been assigned many names, a number of which do not appear in the above synonymy. As in certain other species of boleti, the stem may be either entirely even or more or less reticulated, which has led to confusion. *Boletus illudens,* for example, is a variety with coarse reticulations which has received several names in Europe. This species is of a spongy texture and may be dried in the sun. The cap is usually yellowish-brown or olive-tinted, with a distinct tomentum, and the large tubes and stem are yellow. *C. communis,* a closely related species, usually has more red both in cap and stem.

32. **Ceriomyces tomentipes** (Earle)

Boletus tomentipes Earle, Bull. N. Y. Bot. Gard. **3**: 298. 1905.

This species suggests a gigantic *C. communis.* The tomentum on the cap and stem are peculiar, as is also the change in color of the tubes from yellow to brick-red. Described from specimens collected by C. F. Baker at Stanford University, California.

33. **Ceriomyces fumosipes** (Peck)

Boletus fumosipes Peck, Ann. Rep. N. Y. State Mus. **50**: 108. 1898.

Described from Port Jefferson, New York, from specimens collected by Peck in woods during July. It has since been found abundantly in the mountains of North Carolina both by Atkinson and myself, and I have also collected it at Falls Church, Virginia. The species is peculiar in having a pale bluish-green band at the top of the stipe. The cap is very reticulate-rimose, and the tubes are grayish-white, afterwards discolored by the deep ochraceous-brown spores.

34. **Ceriomyces sordidus** (Frost)

Boletus sordidus Frost, Bull. Buffalo Soc. Nat. Hist. **2**: 105. 1874.

Described from specimens collected by Frost on recent excavations in woods near Brattleboro, Vermont. Represented by four plants in the Frost herbarium, but rather difficult to connect with any specimens collected since. It has many characters in common with *C. fumosipes,* but is not reticulate-rimose. The cap is sordid, flesh white, tubes white, changing to bluish-green, and stem brownish, tinged with green above.

35. **Ceriomyces communis** (Bull.)

Boletus communis Bull. Herb. Fr. *pl. 393A, C.* 1788.
Boletus chrysenteron Bull. Herb. Fr. 328. 1791.
Versipellis chrysenteron Quél. Ench. Fung. 157. 1886.
Xerocomus chrysenteron Quél. Fl. Myc. 418. 1888.
Boletus fraternus Peck, Bull. Torrey Club **24**: 145. 1897. (Type from Auburn, Alabama.)
Boletus umbrosus Atk. Jour. Mycol. **8**: 112. 1902. (Type from Cayuga Lake, New York.)

This species is widely distributed and very common in woods and on mossy banks throughout the temperate regions of Europe and North America, and it has even been collected in certain parts of the Bahamas. As is the case with *C. subtomentosus,* a near relative, the sporophore is spongy-tomentose in texture and dries easily, although it is fleshy enough for food. The cap and stem are usually red, and the tubes yellow and large; the surface of the cap is soft, finely floccose, and often cracked. There are a number of varieties which are rather confusing at times.

DOUBTFUL SPECIES

Most of these might doubtless be referred to well-known species if we knew more about them.

Boletus badiceps Peck, Bull. Torrey Club **27**: 18. 1900. Described from notes and drawings made by McIlvaine from specimens collected in oak woods near Philadelphia, Pennsylvania. Types destroyed.

Boletus Bakeri Tracy & Earle, Pl. Baker. **1**: 23. 1901. Described from specimens collected in moist aspen thickets in Colorado, at an elevation of 9000 ft. Too near *C. crassus* to be recognized as distinct without the discovery of better characters.

Boletus cubensis Berk. & Curt. Jour. Linn. Soc. **10**: 304. 1868. Known only from plants collected on the ground in Cuba by Wright. The types at Kew are pressed flat and show little except the squamulose, spotted character of the surface and the copious spores, which are oblong-ellipsoid, smooth, yellowish-brown, 17–21 × 7μ. Although probably distinct, it is highly desirable to get additional information from fresh specimens before incorporating it into the genus. A *Ceriomyces cubensis* has already been published by Patouillard for a plant in a different group of fungi.

Boletus dictyocephalus Peck, Bull. N. Y. State Mus. **2**: 111. 1889. Described from notes and a single specimen collected by C. J. Curtis in North Carolina. Type not found.

Boletus eccentricus Peck, Bull. Torrey Club **27**: 18. 1900. Described from notes and drawings made by McIlvaine from specimens collected in grassy places in woods at Mt. Gretna, Pennsylvania. Types destroyed.

Boletus fulvus Peck, Bull. Torrey Club **27**: 19. 1900. Not *Boletus fulvus* Scop. Described from notes and drawings made by McIlvaine from twenty or thirty specimens collected on and about an old stump near Philadelphia, Pennsylvania. Types destroyed.

Boletus guadalupensis Pat. Bull. Soc. Fr. **16**: 177. 1900. Described from specimens collected by Duss in Guadeloupe. Types not seen.

Boletus ignoratus Banning; Peck, Ann. Rep. N. Y. State Mus. **44**: 73. 1891. Described from specimens collected near Baltimore,Maryland, by Miss M. E. Banning, who prepared a large manuscript volume, handsomely illustrated, on the fleshy fungi of Maryland, which she donated to the New York State Museum. Types not found.

Boletus leptocephalus Peck, Bull. Torrey Club **25**: 371. 1898. Not *Boletus leptocephalus* Jacquin. Described from specimens collected by Earle in dry pine woods in Alabama. Too near *C.*

crassus to be recognized as distinct without the discovery of better characters.

Boletus lignatilis Berk. & Curt. Jour. Linn. Soc. **10**: 303. 1868. Known only from Berkeley's very brief description drawn from specimens collected on rotten wood in dense woods in Cuba. The types at Kew add nothing to the description.

Boletus Morrisii Peck, Bull. Torrey Club **36**: 154. 1909. Described from specimens collected in sandy soil under scrub oaks at Ellis, Massachusetts. It is closely allied to *C. crassus,* but is said to be well marked by its dotted stem. I have not seen the types.

Boletus mutabilis Morg. Jour. Cincinnati Soc. Nat. Hist. **7**: 6. *pl. 1.* 1884. Not *Boletus mutabilis* of Batsch and others. Described from Ohio. Types not seen. Peck's New York plants of this name are either *C. sordidus* or *Tylopilus felleus.*

Boletus nebulosus Peck, Ann. Rep. N. Y. State Mus. **51**: 292. 1898. Described from mature specimens collected on shaded roadside banks near Raybrook, New York. It has points in common with *C. sordidus* and *Tylopilus felleus.*

Boletus Pocono Schw. Trans. Am. Phil. Soc. **4**: 154. 1832. Described from specimens collected in beech woods in the Pocono Mountains, Pennsylvania. Types destroyed and description inadequate.

Boletus radicosus Bundy, Geol. Wisconsin **1**: 398. 1883. Bundy's specimens are not in existence.

Boletus rimosellus Peck, Bull. N. Y. State Mus. **2**: 127. 1889. Described from notes and one dried specimen collected by C. J. Curtis in North Carolina. Type not found.

Boletus robustus Fries, Nov. Symb. **1**: 46. 1851. Described from specimens collected by Oersted in volcanic soil on the Irasi volcano, Costa Rica. The drawing made by Oersted represents an undeveloped specimen, which might be almost any species. The specimens preserved in spirit could not be found at Copenhagen.

Boletus rubinellus Peck, Ann. Rep. N. Y. State Mus. **32**: 33. 1879. Described from Gansevoort, New York. The description and the type plants indicate points in common with *C. communis* and *C. piperatus,* and it is desirable to study fresh specimens before deciding whether it should be kept distinct or referred to one of these species.

Boletus subpunctipes Peck, Bull. N. Y. State Mus. 116. Bot. **10**: 19. 1907. Described from specimens collected in shaded, sandy soil near Menands, New York. Said to resemble *C. scaber* and *C. chromapes.*

Boletus subsanguineus Peck, Bull. Torrey Club **27**: 17. 1900. Described from notes and drawings made by McIlvaine from specimens collected under beech trees near Philadelphia, Pennsylvania. Types destroyed. Specimens at Albany sent by Willcox from Washington, D. C., are *C. bicolor.*

Boletus tenuiculus Frost, Bull. Buffalo Soc. Nat. Hist. **2**: 103. 1874. Described from Brattleboro, Vermont. The types are poor and the description brief.

Boletus unicolor Frost; Peck, Bull. N. Y. State Mus. **2**: 100. 1889. Published by Peck from manuscript only. Frost's collection contains a single sheet with five poor specimens collected in pine woods and open sedgy places near Brattleboro, Vermont.

INDEX TO SPECIES

NEW YORK BOTANICAL GARDEN.

SPHAERODOTHIS, A NEW GENUS OF DOTHIDIACEOUS FUNGI

C. L. Shear

Sphaerodothis is the name proposed by Saccardo and Sydow in Sylloge Fungorum **16**: 625. 1902, for a subgenus of *Auerswaldia* to include the single species *Auerswaldia arengae* Rac. Par. Alg. and Pilze Java **3**: 27. 1900. The principal character used in separating this subgenus from the genus *Auerswaldia* of Saccardo was the shape of the spores which are spherical or subspherical. The genus *Auerswaldia* Sacc. is, however, untenable, being a homonym of *Auerswaldia* Rabenh., Hedwigia **1**: 116. *t. 15. f. 2.* 1857. Rabenhorst's genus was monotypic, being based on *Sphaeria lagenaria* Pers., which belongs to the earlier genus *Melanospora* Corda, Ic. Fung. **1**: 24. *t. 7. f. 297.* 1837. *Auerswaldia* Rabenh. and *Melanospora* Corda are, therefore, to be regarded as synonyms. Or if it should be maintained that *Sphaeria lagenaria*, the type of *Auerswaldia* Rabenh., is sufficiently different from the type of *Melanospora* to justify a separate genus, such a genus could hardly be made to include the species which Saccardo has referred to his *Auerswaldia*, as they have little in common with *Sphaeria lagenaria* except the continuous brown spores. *Auerswaldia lagenaria* (Pers.) Rabenh. is a hypocreaceous fungus, whereas *A. arengae* Rac. and most of the species included by Saccardo in his *Auerswaldia* are dothideaceous fungi. None of the species congeneric with *A. arengae* Rac. has a tenable generic name at present so far as we have been able to discover, unless some of the older names of pycnidial forms should prove to belong here. There is a possibility that *Lasmenia* of Spegazzini, published in Anal. Soc. Ci. Argent. **22**: 199. 1886, may have been based in part on an old specimen of one of these fungi in which the fugacious asci had disappeared and only the free ascospores remained.

The recent discovery of an apparently undescribed species, evidently congeneric with *Auerswaldia arengae* Rac., the type of the subgenus *Sphaerodothis* has led the writer, for want of a tenable

generic name for the new species, to raise *Sphaerodothis* to generic rank and to transfer to it some of the closely related species which seem to have, at present, no valid generic appellation.

Sphaerodothis gen. nov.

Sphaerodothis sub. gen. Sacc. & Syd., Syll. Fung. **16**: 625. 1902.

The type of the genus is *Auerswaldia Arengae* Rac., which was the monotype of the subgenus of Saccardo and Sydow *l. c.*

Sphaerodothis Neowashingtoniae sp. nov.

Stromata amphigenous, numerous, scattered, subelliptical in outline, irregularly depressed or somewhat collapsed, black, shining, minutely punctate under a lens, 3–8 mm. long, frequently seated on yellowish-brown spots; locules (ascogenous cells) numerous, small, ovate or oblong; ostioles few or wanting, umbilicate; asci fugacious, globose or subglobose, sessile or subsessile, 8-spored, 100–120 μ diam.; paraphyses apparently wanting; spores oblong-elliptic, smooth, somewhat flattened on one side and with a narrow oblong longitudinal depression in the middle, suggesting in appearance a date seed, hyaline at first and enveloped in a thick mucous layer which disappears at maturity when the spores become a deep chestnut brown, 56–68 $\times$ 30–36 μ. Free, mature spores frequently collapse, becoming saddle-shaped.

On leaves of *Neowashingtonia filamentosa,* National City, Cal., Jan. 7, 1907, C. O. Smith Coll. Type, No. 1572, C. L. Shear, in Herb. Dept. Agriculture.

This species appears to be readily distinguished from all others described by the large size and peculiar shape of its spores.

The following species belong to the same genus and should be transferred to it:

Sphaerodothis Chamaeropis (Cke.) comb. nov.

Auerswaldia Chamaeropis (Cke.) Sacc. Syll. Fung. **2**: 626. 1883.

Dothidea Champaeropsidis Cke. Grevillea **7**: 96. 1879.

Sphaerodothis palmicola (Speg.) comb. nov.

Auerswaldia palmicola Speg. Anal. Soc. Ci. Argent. **19**: 247. 1885.

Sphaerodothis rimosa (Speg.) comb. nov.

Auerswaldia rimosa Speg. Anal. Soc. Ci. Argent. **26**: 43. 1888.

Sphaerodothis densa (Bomm. & Rouss.) comb. nov.
Auerswaldia densa Bomm. & Rouss. Bull. Soc. Bot. Belg. **35**: 162. 1896.

Sphaerodothis Guilielmae (Henn.) comb. nov.
Auerswaldia Guilielmae Henn. Hedwigia Beibl. **39**: (78). 1900.

WASHINGTON, D. C.

POLYPORACEAE FROM JAPAN

WILLIAM A. MURRILL

The following interesting collection of Japanese polypores, seventy-one packets in all, was recently received for determination from Professors S. Kusano and S. Nohara, of the Agricultural College, Tokyo Imperial University. The Garden herbarium has formerly contained very little material in this group from Japan, and little has been known of the distribution of the species there, except through the published papers of Professor Hennings, of the Berlin Botanic Garden, who has reported the majority of the fifty or more species known to occur in Japan.

These specimens were collected in Tokyo (including Komaba), Iwaki, Shinano, Shimoosa, Kōnodai, Mt. Takao, Yoyogi, Nikko, Yumoto in Nikko, Oki Province, Formosa and Karafuto. The chief collectors were S. Kusano and S. Nohara, but the following names also appear: K. Miyake, Ch. Tanaka, K. Tanaka, T. Tanaka, Onuma, Yagi and Nakahara. The collector last mentioned obtained most of the specimens sent from Formosa and Karafuto.

Professors Kusano and Nohara are now planning to collect fungi in various parts of Japan on a larger scale, which seems highly desirable, as the mycological flora of Japan is apparently largely unknown at the present time.

Tribe POLYPOREAE

BJERKANDERA ADUSTA (Willd.) Karst. Medd. Soc. Faun. Fl. Fenn. **5**: 38. 1879.

Yoyogi, on dead trunk of *Celtis sinensis, Nohara, 48.* Tokyo, on some dead tree, *Kusano & Nohara, 70.*

BJERKANDERA FUMOSA (Pers.) Karst. Medd. Soc. Faun. Fl. Fenn. **5**: 38. 1879.

Tokyo, on dead trunk of *Populus nigra pyramidalis, Kusano & Nohara, 20;* on *Populus nigra pyramidalis, Onuma, 65.*

COLTRICIA CINNAMOMEA (Jacq.) Murrill, Bull. Torrey Club **31**: 343. 1904.

Tokyo, on the ground, *Nohara, 57.*

Coriolellus Kusanoi sp. nov.

Pileus small, dimidiate, sessile, laterally connate, broadly attached, slightly decurrent, 1.3–2 × 3–5 × 0.2–0.5 cm.; surface pale isabelline, sometimes brownish-discolored in places, glabrous, faintly zonate-sulcate; margin thin, acute, entire, concolorous, rigid, not inflexed on drying: context white, very thin, flexible; tubes concolorous within, about 3 mm. long behind, mouths slightly darker, angular, large, radially elongated, about 2 × 1 mm., edges somewhat thick, rigid, entire: spores hyaline; hyphae hyaline, 3–4 μ; cystidia none.

Type collected on dead *Cryptomeria japonica* at Sōma by S. Kusano, *51*. Also collected on the same host at Tokyo by S. Nohara, *54b*.

CORIOLOPSIS BADIA (Berk.) Murrill, Bull. Torrey Club **34**: 466. 1907.

Karafuto, *Nakahara, 53*.

CORIOLUS ABIETINUS (Dicks.) Quél. Ench. Fung. 175. 1886.

This species has been confused by some with *Polystictus pellucidus* Berk. (Challenger No. 263), described from specimens collected in Japan on slender stems of herbaceous plants. The description of this latter species much resembles that of *C. abietinus*, but the habitat as given is entirely impossible for it.

Mt. Takao, *T. Tanaka, 43*. Tokyo, on dead *Cryptomeria, Nohara, 45*.

CORIOLUS NIGROMARGINATUS (Schw.) Murrill, Bull. Torrey Club **32**: 649. 1906.

Tokyo, *Nohara, 69;* on *Prunus* sp., *Kusano & Nohara, 41;* on dead cherry tree, *Kusano, 41a*.

CORIOLUS PROLIFICANS (Fries) Murrill, N. Am. Flora **9**: 27. 1907.

Settsu, on a species of *Pinus, Ch. Tanaka, 62*.

CORIOLUS VERSICOLOR (L.) Quél. Ench. Fung. 175. 1886.

Iwaki, *Kusano, 24*. Tokyo, *Ch. Tanaka, 63a, 63b*.

EARLIELLA CORRUGATA (Pers.) Murrill, Bull. Torrey Club **34**: 468. 1907.

Formosa, on some tree, *Miyake, 22*.

FAVOLUS TENUIS (Hook.) Murrill, Bull. Torrey Club **32**: 100. 1905.

Formosa, *Nakahara, 21*.

HAPALOPILUS GILVUS (Schw.) Murrill, Bull. Torrey Club **31**: 418. 1904. No. 10 is probably what Hennings has described as *Polyporus illicicola* (Engl. Bot. Jahrb. **32**: 39. 1903). It differs from the ordinary forms of *H. gilvus* chiefly in its tomentose-asperate surface. No. 15a is an old resupinate specimen, with spores and cystidia corresponding to those of *H. gilvus*.

Tokyo, on dead *Cornus macrophyllus, Kusano & Nohara, 10;* on *Quercus* sp., *Kusano & Nohara, 50.* Nikko, on dead *Betula, Kusano & Nohara, 15a.*

INONOTUS RADIATUS (Sow.) Karst. Rev. Myc. **3**[e]: 19. 1881.

Tokyo, on living *Prunus, Ch. Tanaka, 60.*

Irpiciporus consors (Berk.) Murrill. *Irpex consors* Berk. Jour. Linn. Soc. Bot. **16**: 51. 1878. Described from specimens collected at Kobi, Japan, on the Challenger expedition.

Tokyo, on dead stump of *Quercus, Nohara, 47.*

Irpiciporus japonicus sp. nov.

Pilei sessile, dimidiate, conchate, imbricate, united behind by mostly sterile tissue, 0.3–0.7 × 0.7–1 × 0.1–0.3 cm.; surface slightly zonate, glabrous, with silky luster, pale isabelline in dried specimens; margin thin, undulate, slightly inflexed on drying, ochraceous under a lens: context white, membranous; tubes large, irregular, angular, irpiciform at a very early stage, concolorous with the surface of the pileus, 1–3 to a mm., 3 mm. long behind, shorter in front, edges sharp, toothed: spores hyaline; hyphae hyaline, 3–4 μ; cystidia none.

Type collected on dead *Quercus* at Tokyo in October, 1908, by S. Kusano and S. Nohara, *28.*

IRPICIPORUS LACTEUS (Fries) Murrill, N. Am. Flora **9**: 15. 1907.

Nikko, on a log of *Prunus* (?), *Kusano & Nohara, 2.*

Irpiciporus Noharae sp. nov.

Pileus semiresupinate, the resupinate portion nearly circular in outline, the reflexed portion dimidiate, thin, conchate, imbricate, 1–1.5 × 1.5–4 × 0.1–0.2 cm.; surface zonate-sulcate, hirsute-tomentose, avellanous-isabelline with pale fulvous markings; margin undulate, thin, concolorous, tomentose, inflexed on drying: context white, thin, flexible; tubes large and irregular, shallow, irpiciform at an early stage, white to slightly isabelline, 1–2 mm. long, 1–2 to a mm., edges sharp, irregular, crested and toothed: spores hyaline; hyphae hyaline; cystidia none.

Type collected on dead *Hibiscus syriacus* at Kōnodai, October, 1908, by S. Nohara, *49*.

Irpiciporus Tanakae sp. nov.

Pileus sessile, conchate, imbricate, decurrent behind, 1 × 1–2 × 1–0.3 cm.; surface pure white, glabrous, nearly smooth, azonate, opaque; margin thin, entire, concolorous, slightly striate, strongly inflexed on drying: context white, membranous; tubes large, irregular, more or less radially confluent, pale isabelline, 1–2 mm. in diameter, about 2 mm. long behind, the decurrent edges longer, the dissepiments irregularly toothed, acute: spores elongated, smooth, hyaline; hyphae hyaline, 2–3 μ; cystidia none.

Type collected on dead *Cryptomeria* on Mt. Takao by Ch. Tanaka, *54a*.

LAETIPORUS SPECIOSUS (Battar.) Murrill, Bull. Torrey Club **31**: 607. 1904.

Nikko, on *Tsuga* sp., *Kusano & Nohara, 6*.

PIPTOPORUS SUBEROSUS (L.) Murrill, Jour. Myc. **9**: 94. 1903.

Nikko, Yumoto, on *Betula* sp., *Kusano, 27*.

POLYPORUS ARCULARIUS (Batsch.) Fries, Syst. Myc. **1**: 342. 1821.

Tokyo, on *Prunus* sp., *Kusano & Nohara, 46*.

POLYPORUS CELEBICUS P. Henn. Monsunia **1**: 12. *pl. 1. f. 5*. 1899.

Tokyo, on stump of *Quercus glandulifera, Kusano & Nohara, 1*.

POLYPORUS PERULA (Beauv.) Fr. Epicr. 437. 1838.

Formosa, on a root of some dead tree, *Nakahara, 7*.

PYCNOPORUS SANGUINEUS (L.) Murrill, Bull. Torrey Club **31**: 421. 1904.

Tokyo, on dead stem of *Prunus* sp., *Kusano & Nohara, 13*. Formosa, on *Pandanus* sp., *Nakahara, 19*.

TRAMETES DICKINSII Berk. Sacc. Sylloge Fung. **9**: 196. 1891.

Collected by Dickins in Japan and named by Berkeley, but not published until the diagnosis was sent to Saccardo by Cooke. It must not be confused with *Polyporus Dickinsii* Berk. (Jour. Linn. Soc. Bot. **16**: 50. 1878), also from Japan, which is very different, being very thin and having large, shallow tubes. *Trametes nitida* Pat. (Jour. de Bot. **4**: 17. 1890), described from Tonkin, is a resupinate form very much resembling *Tr. Dickinsii*.

Nikko, on dead *Quercus aliena, Kusano & Nohara, 3*. Oki Province, *Kusano & Nohara, 26*.

TRAMETES MÜLLERI Berk. Jour. Linn. Soc. Bot. **10**: 320. 1868. Formosa?, *Nakahara?, 36.*

Whitfordia musashiensis (P. Henn.). *Fomes musashiensis* P. Henn. Engl. Bot. Jahrb. **31**: 737. 1902.
Shibuya, near Tokyo, *Ch. Tanaka, 59.*

Tribe FOMITEAE

ELFVINGIA FOMENTARIA (L.) Murrill, Bull. Torrey Club **30**: 298. 1903. Most of the specimens represent the form common in southern Europe.
Nikko, on dead *Betula* sp., *Kusano & Nohara, 5, 18, 38;* on some dead tree, *Kusano & Nohara, 15.* Karafuto, *Nakahara, 31, 34.*

ELFVINGIA LIPSIENSIS (Batsch) Murrill, Bull. Torrey Club **30**: 297. 1903. No. 29 is an indurated, almost resupinate form, having the young hymenium covered with a yellow layer, as sometimes occurs in *E. megaloma* and *E. tornata.*
Nikko, on dead *Betula* sp.?, *Kusano & Nohara, 14.* Shimoosa, *Onuma, 32.* Tokyo, *Kusano, 52;* on *Ailanthus glandulosa, Onuma, 30.* Shinano, on *Prunus* sp., *Yagi, 29.*

ELFVINGIA TORNATA (Pers.) Murrill, Bull. Torrey Club **30**: 301. 1903.
Formosa, *Miyake, 39.*

FOMES FRAXINEUS (Bull.) Cooke, Grevillea **14**: 21. 1885. This species is usually found on ash in Europe and America.
Tokyo, on a cherry tree, *Nohara, 55.* Shinano, on *Prunus, K. Tanaka, 11.* Locality not stated, *Kusano & Nohara, 35.*

FOMES UNGULATUS (Schaeff.) Sacc. Syll. Fung. **6**: 167. 1888.
Locality not stated, *Nakahara, 25.* Karafuto, *Nakahara, 33.*

GANODERMA AMBOINENSE (Lam.) Pat. Bull. Soc. Myc. Fr. **5**: 70. 1889.
Nikko, on some dead tree, *Kusano & Nohara, 8.*

GANODERMA FLABELLIFORME (Scop.) Murrill, Torreya **4**: 165. 1904. The specimen is old and the host is not given, thus leaving the determination somewhat in doubt.
Nikko, Yumoto, *Kusano, 37.*

PYROPOLYPORUS FASTUOSUS (Lév.) Murrill, Bull. Torrey Club **34**: 479. 1907.

Formosa, on dead tree, *Nakahara, 9.*

Tribe DAEDALEAE

CERRENA UNICOLOR (Bull.) Murrill, Jour. Myc. **9**: 91. 1903.

Tokyo, on dead limbs of *Styrax Obassia, Kusano & Nohara, 4.*

CYCLOMYCES FUSCUS Fr. Linnaea **5**: 512. *pl. 11. f. 3.* 1830. Japan is rather far north for this species.

Tokyo, on *Pasama cuspidata, Nohara, 67.*

Daedalea Kusanoi sp. nov.

Pileus sessile, dimidiate, applanate or slightly convex above, plane or convex below, somewhat imbricate, slightly decurrent, 3–4 × 5–6 × 1.5–2 cm.; surface very slightly sulcate, nearly glabrous, very pale isabelline; margin entire or undulate, acute, rigid, not inflexed on drying, concolorous: context white or nearly white, corky, homogeneous, 3–5 mm. thick; tubes labyrinthiform, pale isabelline, nearly 1 cm. long behind, the furrows 0.5–2 cm. long and 1–2 mm. broad, edges thick, obtuse, entire, somewhat uneven; spores subglobose to ovoid, smooth, hyaline; hyphae hyaline, 4–6 μ thick; cystidia none.

Type collected on a dead trunk in the Botanical Garden at Tokyo in 1901 by S. Kusano, *40, 64* (*duplicate*).

GLOEOPHYLLUM TRABEUM (Pers.) Murrill, N. Am. Flora **9**: 129. 1908.

Tokyo, on dead *Cryptomeria japonica, Kusano & Nohara, 17;* on *Cryptomeria japonica,* half-burned log, *Nohara, 44.*

LENZITES BETULINA (L.) Fries, Epicr. Myc. 405. 1838.

Shinano, on stump of a dead willow, *K. Tanaka, 12.* Iwaki, *Kusano, 23.* Tokyo, on old rail, *Kusano & Nohara, 68.*

ADDITIONAL SPECIES REPORTED FROM JAPAN

The following list contains the principal pileate species of Polyporaceae reported from Japan, which are not included above. Since the determinations have not been verified except in a few cases, no attempt is here made to group the species in accordance with my own classification.

Irpex decurrens Berk., *Irpex Kusanoi* P. Henn. & Shir.; *Hyd-*

nofomes tsugicola P. Henn.; *Polyporus membranaceus* (Sw.) Fr., *Polyporus cinnabarinus* (Jacq.) Fr., *Polyporus pellucidus* Berk., *Polyporus ochrotinctus* Berk., *Polyporus vernicipes* Berk., *Polyporus Dickinsii* Berk., *Polyporus Pocas* Berk., *Polyporus Pocula* (Schw.) B. & C., *Polyporus officinalis* (Vill.) Fr., *Polyporus Schweinitzii* Fr., *Polyporus glaucotus* Cooke, *Polyporus illicicola* P. Henn., *Polyporus Shiraianus* P. Henn. (=*Pycnoporellus fibrillosus* (Karst.) Murrill), *Polyporus Shenoi* P. Henn.; *Polystictus Cryptomeriae* P. Henn., *Polystictus Ikenoi* P. Henn.; *Trametes styracicola* P. Henn.

Fomes fulvus (Fr.) Gill., *Fomes rimosus* (Berk.) Cooke, *Fomes igniarius* (L.) Gill., *Fomes Ribis* (Schum.) Gill., *Fomes volvatus* (Peck) Cooke, *Fomes concentricus* Cooke, *Fomes japonicus* (Fr.) Cooke; *Daedalea quercina* Pers., *Daedalea styracina* P. Henn. & Shir.; *Lenzites japonica* Berk., *Lenzites alutacea* Cooke, *Lenzites saepiaria* (Wulf.) Fr., *Lenzites variegata* Fr.

NEW YORK BOTANICAL GARDEN.

NEWS AND NOTES

Frequent requests are made for sample copies of the first numbers of MYCOLOGIA. We should be glad to receive duplicate copies of these numbers that are not in use.

The importance of the subject of pyrophilous fungi leads us to request those interested to make careful notes on all forms observed during the summer and autumn and to send them with the dried specimens to Mr. Seaver for critical examination.

We learn from *Science* that the Tennessee legislature has passed a bill giving twenty-five per cent. of the state's revenue for education, seven per cent. being for the university and experiment station.

Mr. Elam Bartholomew, editor and publisher of *Fungi Columbiani,* left his home in Stockton, Kansas, in June for a collecting trip of ten weeks on the Pacific Coast.

The mycological papers presented at the recent Baltimore meeting of the A. A. A. S. are reviewed in the number of *Science* issued June 4, 1909.

A valuable paper by F. A. Stockdale on the fungus diseases of cocoanuts in the West Indies appeared in the *West Indian Bulletin* 9: 361–381. 1909.

The Garden has recently received from Père Duss 113 packets

of fungi collected by him in Guadeloupe. Most of the fungi collected by Duss have been worked over by Dr. N. Patouillard, of Paris.

Professor F. L. Stevens, of the North Carolina Experiment Station, expects to visit the agricultural colleges and experiment stations of Europe during the summer.

Mr. J. R. Johnston, of the Bureau of Plant Industry at Washington, has recently been studying the bud-rot of the cocoanut in Cuba.

A paper by Freda M. Bachman on the Discomycetes in the Vicinity of Oxford, Ohio, is published in the proceedings of the Ohio State Academy of Science **5**: 19–70. 1909. The paper contains a description of more than sixty species occurring in that region, and is accompanied by four plates with sixty-two figures.

The Transactions of the Nova Scotia Institute of Science **12**: 165–205, 1909, contains a descriptive list of the Myxomycetes of Pictou County, by C. L. Moore. Four plates, illustrating the principal genera, accompany the text.

Part two of the Xylariaceae of Southern Brasil, by F. Thiessen, appeared in the April number of Annales Mycologici (**7**: 141–167. 1909). The paper is devoted mainly to the genus *Hypoxylon*, twenty-nine species and several varieties being listed, including one new species, *Hypoxylon verrucosum* Thiess. The subject of classification is discussed at some length.

The leaf-blight of the plane-tree (*Gloeosporium nervisequum*) became very noticeable on the Garden grounds during the first week in June, but the attacks of the fungus did not appear to be particularly injurious this season.

According to Mr. Perley Spaulding, of the U. S. Dept. of Agriculture, the white pine blight includes several distinct diseases: a leaf blight accompanied by *Septoria parasitica,* two leaf diseases caused by *Lophodermium brachysporum* and *Hypoderma lineare,* a leaf and twig blight caused by winter freezing, and a twig blight, probably caused by insects.

Mr. W. M. Scott, of the Bureau of Plant Industry, Washington, D. C., has been conducting experiments for the past two years in various states with lime-sulphur mixtures for the summer spraying of orchards. Circular 27, of that bureau, is a report of the second season's experiments on peach, apple and cherry orchards. The experiments resulted in certain modifications of the mixtures for the peach and the Japanese plum, but were very encouraging for further experiments and for widespread use in the orchard where Bordeaux mixture is found objectionable.

The Classification of the Basidiomycetes is discussed in a recent article by M. Léon Dufour (Rev. Gén. Bot. **20**: 417–429. 1908), in which he proposes for the higher Autobasidiomycetes three principal divisions: the Cantharellineae, including *Clavaria, Thelephora, Hydnum, Craterellus* and *Cantharellus;* the Polyporineae, ranging from *Polyporus* to *Fistulina,* and related to the preceding group by such genera as *Cyphella* and *Dictyolus;* and the Agaricineae, comprising *Boletus, Paxillus,* and a series of genera culminating in *Amanita.* The Polyporineae are characterized as a heterogeneous group which will probably have to be divided. In closing, the author states that the difficult problem of classifying the Basidiomycetes is just on the point of being solved.

The Boletaceae of North America will be published in monograph form at the close of the year. Specimens of these plants are desired from as many stations as possible. Species may be determined more or less accurately in the fresh condition by the use of the keys published in this number and in No. 1 of MYCOLOGIA. All specimens should be thoroughly dried by artificial heat, using a piece of wire netting suspended over a lamp or stove, or some other contrivance, and afterwards packed in boxes with naphthalene or moth balls.

The present season was somewhat earlier than usual for the larger fleshy fungi. *Coprinus micaceus* appeared April 15, and has been abundant since that time, after rains. A few plants of *Coprinus comatus* appeared about May 15 on a lawn where they grew late last fall, but these were probably exceptional, having passed the mild winter in the button stage. *Pleurotus sapidus* was fully grown and abundant on May 1. *Pluteus cervinus* occurred in great quantity on an old sawdust pile on May 15. Before the end of May *Clitocybe multiceps* appeared on a lawn where it grew last autumn, and has been abundant since. *Polyporus caudicinus* always matures early, so it was not surprising to find it in May; and the same is true of *Morchella*. A number of small fleshy forms appeared in fields and on roadsides during May and early June, but this is not unusual. A few plants of *Coprinus atramentarius* and *Hypholoma appendiculatum*, however, came as a surprise about May 15. On June 4, eighteen specimens of *Agaricus campestris* were collected in a field not far from Bronx Park.

"The Association internationale des Botanistes founded, some years ago, an office where pure cultures of fungi can be obtained, either in exchange or on payment. The above-mentioned office proposes to compose a living register of the described fungi. Large numbers of species are mentioned in the handbooks which are said to be insufficiently described and which cannot possibly

be identified. The number of identical species, described under different names, is immense. This evil may be avoided in future if every mycologist, when describing a new fungus, sends a culture to the office of the Association. The author not only is relieved of the cultivation, but every one who is studying kindred species may procure material for comparison.

"Rather often applications are made to the office, but the collection does not grow in proportion to the description of new species. It has often occurred to us that on our requesting a person to send us a culture of a certain recently described fungus, the author was obliged to reply that as the work was passing through the press the cultures were lost. We beg you not to send the new species only but also those of which you have pure cultures and which are not mentioned on our list, published regularly in the 'Botanisches Centralblatt,' because many species are asked for which we do not possess. You are requested to tell us whether the species left to our care want frequent renewing. The greater part of our cultures are transferred but once every three months, but many of them want particular care.

"We beg to state again our terms, which are 3 florins (Dutch money) for non-members and 1.50 florins for the members of the Association."

(Signed) DR. JOHANNA WESTERDIGH,
Roemer Visscherstraat 1,
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